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## The taxonomy of Steppe and Tawny Eagles, with criteria for separation of museum specimens and live eagles

by William S. Clark

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The Steppe Eagle of the steppes and plains of Asia and eastern Europe and the Tawny Eagle of the savannas of India and Africa were long considered separate species, *Aquila nipalensis* and *A. rapax* respectively, in checklists (Peters 1931, Swann 1931) and regional bird handbooks (e.g. Baker 1928).

Beginning in the 1950s, some authorities (Meinertzhagen 1951, 1954, Vaurie 1965, Brown & Amadon 1968, and others) treated them as races of a single species, for which the oldest name is *A. rapax*. Others, however, continued to regard them as separate species (Grossman & Hamlet 1964, Porter *et al.* 1981, Christensen *et al.* 1981; see especially Brooke *et al.* 1972, Amadon 1982). Most who considered them races (e.g. Glutz

von Blotzheim *et al.* 1971, Cramp & Simmons 1980) nevertheless treated them as separate entities because of their differences. Amadon (Stresemann & Amadon 1979) altered Stresemann's original manuscript by combining *nipalensis* with *rapax*. Clancey (1966) considered them component allospecies of a superspecies. The taxonomic arrangement of these eagles in Sibley & Monroe (1990) will be amended in a future revision that will place *nipalensis* and *orientalis* together as the Steppe Eagle *Aquila nipalensis* and will place *vindhiana* and the African forms together as the Tawny Eagle *A. rapax* (B. L. Monroe, pers. comm.).

The taxa involved are:

Steppe Eagle, consisting of two contiguous subspecies in the Palaearctic, *orientalis* in the west and *nipalensis* in the east, that differ only in size. Variation is clinal, larger birds occurring in the east. Both are entirely migratory (Dementiev & Gladkov 1966).

Tawny Eagle, consisting of three subspecies, *rapax* and *belisarius*, contiguous in southern and northern (respectively) Africa and southern Arabia, and *vindhiana* in India. All three are sedentary. Despite present (but presumably not past) separation from African races, *vindhiana* is not very different (Brown & Amadon 1968).

The lack of consensus on the taxonomic status of these eagles has caused confusion; the common names Tawny Eagle and Steppe Eagle are sometimes used interchangeably and sometimes to refer to distinct forms.

Apparently the main reason that various authors considered these eagles conspecific is that they could not distinguish all individuals (e.g. Meinertzhagen 1954). Herein I present criteria for the correct identification of all museum specimens and live birds in the hand of both eagles by either morphology or plumage.

Based on my museum and field experience with Steppe and Tawny Eagles in Israel, Egypt, Kenya and India. I find them to differ in plumage, structure and proportions, flight, feeding ecology, and breeding habitat. I suggest that taxonomists reconsider the reasons for treating them as conspecific.

### Sources and methods

Information on Steppe and Tawny Eagles was gathered by searching the pertinent literature (LeFranc & Clark 1983), by studying museum specimens, and by observing and photographing both forms in the field.

All specimens of both forms ( $n > 100$ ) were examined and studied in the collections of the American Museum of Natural History (AMNH), United States National Museum of Natural History (NMNH), Bombay Natural History Society (BNHS), Tel-Aviv University, and Philadelphia Academy of Natural Sciences. Standard measurements of wing chord, exposed culmen and hallux length were taken on each specimen. In addition, two measurements were taken on the gape; one was the width from one edge of the mouth to the other, and the second was the length from the edge of the mouth to a point directly below the vertical line where the upper mandible enters the skin. Plumage details of each specimen, particularly those with plumage types shared by both eagles, were noted. After a draft of this paper had been prepared, all specimens of

both forms ( $n > 200$ ) in the British Museum (Natural History) (BMNH) were examined.

Thousands of Steppe Eagles were observed and many photographed in Israel and Egypt between 1980 and 1988. Tawny Eagles were observed and photographed in Kenya in 1986, and both eagles were observed and photographed in India in 1985, 1990 and 1991. The photographs were studied for structure and plumage detail. Thirteen Steppe Eagles captured for ringing in Israel were photographed in the hand. Dozens of Steppe Eagles that were in rehabilitation centres in Israel were observed closely, as were three Indian Tawny Eagles sent to Israel for release.

## Results

As detailed in many references and observed in all specimens and many photographs, Steppe Eagles and Tawny Eagles differ in plumage, overall size and proportions, structure of beak and gape, and ecological niche; in particular, there are differences in breeding habitat, in prey, and in hunting, social and migratory behaviour. Three similar plumages are shared, but on closer inspection, all are distinct.

All museum specimens and live eagles in the hand can be identified as Steppe or Tawny either by gape measurements or by plumage; consistent results are provided by both methods. In spite of this, I found dozens of museum specimens of one eagle misidentified as the other, or even as other eagles.

### Literature

Most field researchers studying birds of prey in eastern and southern Africa, where both eagles occur during the northern winter, consider them to be separate species (e.g. Irwin & Benson 1986, Dowsett & Dowsett-Lemaire 1980, Steyn 1982). Brooke *et al.* (1972) list differences in plumage, structure, iris colour in adult, food preferences, and migratory and social behaviour as reasons for separation. Kozlova (1975), who studied the Steppe Eagle in the Soviet Union, also considered it specifically distinct from the Tawny Eagle.

Amadon & Bull (1988) wrote: "See Snow (1978) for reasons for keeping it [*nipalensis*] a subspecies of *A. rapax*." However, Snow (1978) argued rather unconvincingly that North African birds (*belisarius*) were intermediate, perhaps because they have a dark morph, lacking in southern Africa. Note that Amadon (1982) previously considered them separate species.

### Ecological niche

Tawny and Steppe Eagles are allopatric, despite hints in the literature that their breeding ranges overlap in India. There are no breeding records for the Steppe Eagle from India (Baker 1928, Ali & Ripley 1978), which is not surprising, as its breeding habitat is arid steppe (Dementiev & Gladkov 1966). The Tawny Eagle, on the other hand, breeds in a variety of grassy savanna habitats in India and Africa (Ali & Ripley 1978, Brown *et al.* 1982).

Tawny Eagles are active predators that take a wide range of prey from small to large; Steyn (1982) states that they capture mammals up to twice their weight and have even struck down flamingos. Smeenk (1974) studied their food in detail in East Africa and wrote: "Summarizing, the Tawny Eagle is ecologically the most wide-ranging large African bird of prey, taking whatever ground animals are readily available, from insects to small antelopes; scavenging and robbing of other predators are practised wherever there is an opportunity." Steyn (1973) also reported a wide range of prey for Tawny Eagles. On the other hand, Steppe Eagles on the breeding grounds specialize in capturing small mammals, mainly rodents (Dementiev & Gladkov 1966). Tyurekhodzhaev (1977) reported that 90% of the Steppe Eagle's diet are sousliks (ground squirrels) *Citellus pygmaeus*. Semenov *et al.* (1962) found that Steppe Eagle and souslik populations fluctuated in synchrony. From the literature it is clear that they do not take nearly as wide a range of prey, nor take prey as large, as do Tawny Eagles, either when breeding (Cramp & Simmons 1980) or on wintering grounds (Brooke *et al.* 1972, Steyn 1982).

From my field observations, Tawny Eagles appear to be much more active predators than Steppe Eagles; a view shared by Steyn (1982), who wrote about the Tawny: "It is a rapacious eagle, as its specific name *rapax* correctly indicates." While airborne, both eagles will drop on prey and chase other predators to attempt piracy, but only the Tawny consistently uses powered flight to chase both prey and other predators.

Another difference between these eagles is that the entire population of Steppe Eagles leaves the breeding ground and migrates to either India or Africa (Dementiev & Gladkov 1966, Cramp & Simmons 1980). The Tawny Eagle is mostly sedentary; movements, if any, are usually in response to wet or dry season (Thiollay 1978).

Finally, Steppe Eagles are rather social, gathering in small to large groups to feed and migrate and forming communal night roosts (Brooke *et al.* 1972). Tawny Eagles are usually solitary or, at most, occur as pairs and are not reported to form communal night roosts.

### Plumages

Steppe and Tawny Eagles differ considerably in plumage at all ages, particularly differing in the variety of plumages. Tawny Eagles are polymorphic and vary greatly in plumage; but the plumages of individuals change little with age, with the exception of the dark-breasted birds mentioned below. Steppe Eagles' plumages are much less variable within age classes; most variation is with age, birds becoming much darker as adults.

Adult Tawny Eagles' underparts vary from solid pale creamy, solid tawny, or solid rufous to tawny with rufous streaking or rufous with dark brown streaking, to uniform dark brown. Adult Steppe Eagles are less variable and have solid dark brown underparts.

Many, if not all, non dark-morph Tawny Eagles have a plumage that is quite different from any Steppe Eagle plumage. This is characterized by a dark brown breast and pale belly and is most likely worn for a year or two between juvenile and adult plumages.

Juvenile and first-year Tawny Eagles likewise show a wide variety of underparts colour, varying from solid pale creamy to solid dark brown with almost every intermediate shade.

Nevertheless, Steppe and Tawny Eagles have three similarly coloured plumages in common: dark-brown, grey-brown, and rufous-tawny, so called because of the bird's overall colour. However, on close inspection, all three are consistently different in several details, as set out below.

#### Tawny Eagle

Adult. Dark-morph is solid dark brown; nape dark, often with pale feather tips.

Iris is yellow.

Younger birds have paler leg feathers and undertail coverts and often pale spots on nape and belly. Coverts are uniformly coloured.

#### Solid dark brown colour

Adult. Always have rufous nape patch.

Iris is brown, pale flecking.

Subadults head and back paler; they may lack nape patch. Their undertail, uppertail, and greater primary underwing coverts are brown and white.

#### Steppe Eagle

#### Grey-brown or rufous-tawny colouration

All ages. Underwing coverts are uniformly coloured. Juveniles and first summer birds have narrow white tips to unbarred secondaries. Undertail coverts are same colour as belly. Uppertail coverts are same colour as back, not white.

Rufous-tawny birds are common; grey-brown birds occur frequently.

First three years. Wide white tips to barred secondaries and greater upperwing and underwing coverts on most birds; always on greater primary underwing coverts. Undertail coverts white, contrast with brown belly. Uppertail coverts are white.

Rufous-tawny birds are rare; grey-brown birds are common.

### Structure

The most consistent and easily measured morphological difference between these eagles is the size of the gape. As shown in Jankowitz (1976) and Biggs & Biggs (1978), this is proportionally larger in the Steppe Eagle. Two gape measurements can be used to identify all individuals, either alive or dead (Table 1). Extremely large female Tawny Eagles and small male Steppe Eagles overlap slightly, but accurate sex information and plumage characters will serve to separate them in these cases.

While Steppe Eagles are generally larger, there are overlaps in the measurements of wing chord, exposed culmen and hallux, even between individuals of the same sex. However, as Brooke *et al.* (1972) pointed out, Steppe Eagles are more sexually dimorphic in hallux length than are Tawny Eagles, though my measurements (Table 2) do not indicate as much difference as do theirs.

In flight Tawny Eagles show a more classic aquiline silhouette (Steyn 1982); compared to flying Steppe Eagles, they tend to show a longer head and neck projection and to hold their wing less drooped when soaring and gliding. Steppe Eagles, when perched on the ground, appear more horizontal and elongated than Tawny Eagles, which stand more erect and do not appear elongated.

Steppe Eagles reach definitive or adult plumage by 4 years of age (Dementiev & Gladkov 1966). Confirming this I found only 4 non-adult plumages; this conclusion is based on moult, primarily of the secondaries. Age to maturity is thus not a definitive difference between these eagles as suggested by Brooke *et al.* (1972), who thought that it took Steppe Eagles

TABLE 1  
Gape measurements of Tawny and Steppe Eagles

	Mean width (mm)		Mean length (mm)	
	Male	Female	Male	Female
Tawny Eagle (range)	43.6 (50) (40.3-47.8)	44.5 (50) (40.8-49.9)	34.0 (50) (30.0-37.5)	35.0 (50) (33.2-41.0)
Steppe Eagle (range)	53.1 (37) (49.0-58.1)	55.3 (31) (52.3-60.8)	44.3 (38) (40.0-48.0)	45.8 (34) (41.8-49.7)

*Note.* There is no overlap in measurements within sexes and only a slight overlap between forms.

TABLE 2  
Hallux measurements of Tawny and Steppe Eagles

	Mean length (mm)	
	Male	Female
Tawny Eagle (range)	31.6 (50) (27.0-36.9)	33.0 (50) (29.0-37.0)
Steppe Eagle (range)	33.8 (38) (28.3-36.8)	36.0 (34) (31.8-40.5)

*Note.* Steppe Eagles are somewhat more dimorphic in hallux measurement than are Tawny Eagles.

6 or 7 years and Tawny Eagles only 4. It is unlikely that Steppe Eagles differ from other large eagles that reach maturity in 4 or at most 5 years, e.g. Golden Eagle *Aquila chrysaetos* (Jollie 1947), Bald Eagle *Haliaeetus leucocephalus* (McCullough 1989), and White-tailed Eagle *H. albicilla* (Forsman 1981).

## Discussion

That Tawny and Steppe Eagles differ almost everyone agrees; even most authorities who have considered them conspecific have treated them separately. What is disputed is their taxonomic relationship. Are they one species or two?

There is a surprising paucity of supporting arguments given by the various authorities who considered them conspecific; Snow (1978) based his argument on the false assumption that the breeding range of Steppe Eagles and Indian Tawny Eagles were contiguous (and, as a result, that they intergraded). The single consistently stated reason for lumping them was that some individuals appeared identical, or nearly identical, to

individuals of the other eagle. This argument is not convincing, considering that general similarity of appearance plays a minor part in our present thinking on what constitutes a species and that now all individuals of these eagles can be correctly identified. Behavioural differences, particularly those relating to mate selection, are now considered more important in defining species differences.

Misidentification of museum specimens of these eagles has hampered efforts to study their taxonomic status. This was, no doubt, one source of confusion to some authors who examined and compared misidentified with correctly identified specimens of each eagle and, finding no differences, considered them conspecific. Similarly, lack of discrimination in the field during the periods when both species occur in Africa and India has further blurred the difference between them, particularly behavioural differences.

Avian taxonomy has been aided by new laboratory analytic techniques that compare genetic material or blood proteins from two or more forms; use of these techniques would help determine the true taxonomic relationship of these eagles. However, the conclusive test of whether they are one or two species would be if their breeding ranges overlapped. Should this happen, I believe that Steppe and Tawny Eagles would not interbreed because of their ecological and behavioural differences.

In summary, Steppe Eagles and Tawny Eagles differ in the following taxonomic characters: morphological (plumage, gape structure, and hallux dimorphism), ecological (food and breeding habitat), and ethological (hunting, social, and migratory behaviours). Combining them was based solely on superficial similarities. Steppe Eagles and Tawny Eagles should be considered separate species, *A. nipalensis* and *A. rapax*.

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